CLAIMS

We claim:

1. An optical device comprising:

a freestanding membrane comprising a plurality of thin-film layers represented by L(i), i=1, 2, 3, ..., N where N is a positive odd integer; and

said membrane having a mirror symmetrical layer structure relative to a middle layer L(m) where m=(N+1)/2, and layer L(m-j) and layer L(m+j) having a same thickness, material composition, shape and size, where j=1, 2, 3, ...,(N-1)/2.

2. The optical device of claim 1 further comprising:

an electromagnetic means for controlling and moving said freestanding membrane.

3. The optical device of claim 1 wherein:

said layers L(i) having an alternate high-low refraction index configuration with layers $L(i_H)$ having a set of relatively higher refraction indexes and layers $L(i_L)$ having a set of relatively lower refraction indexes where i_H = 1, 3, 5, N and i_L =2, 4, 6, ..., (N-1).

4. The optical device of claim 1 wherein:

said layers L(i) having an alternate high-low refraction index configuration with layers $L(i_H)$ having a set of relatively higher refraction indexes and layers $L(i_L)$ having a set of relatively lower refraction indexes where i_L = 1, 3, 5, ...,N and i_H =2, 4, 6, ..., (N-1).

5. The optical device of claim 1 further comprising:

a resonant cavity supported on a silicon substrate covered by said freestanding membrane.

6. The optical device of claim 5 further comprising:

an antireflection (AR) layer coated on the bottom of said silicon substrate.

7. The optical device of claim 1 wherein:

at least one of said layers L(i), i =1, 2, 3, …N, is a polysilicon layer.

8. The optical device of claim 1 wherein:

at least one of said layers L(i), i =1, 2, 3, …N, is a silicon nitride layer.

9. The optical device of claim 1 further comprising:

a HR coating layer coated on said freestanding membrane.

10. A freestanding membrane comprising:

a plurality of thin-film layers represented by L(i), i=1, 2, 3, …, N where N is a positive odd integer; and

said thin film layers having a mirror symmetrical layer structure relative to a middle layer L(m) where m=(N+1)/2, and layer L(m-j) and layer L(m+j) having a same thickness, material composition, shape and size, where j=1, 2, 3, …,(N-1)/2.

11. An method for manufacturing an optical device comprising:

forming a freestanding membrane with a plurality of thin-film layers represented by L(i), i=1, 2, 3, ..., N where N is a positive odd integer; and

configuring said thin film layers with a mirror symmetrical layer structure relative to a middle layer L(m) where m=(N+1)/2, and layer L(m-j) and layer L(m+j) having a same thickness, material composition, shape and size, where j=1, 2, 3, ...,(N-1)/2.

12. The method of claim 11 further comprising:

controlling and moving said freestanding membrane with an electromagnetic means.

13. The method of claim 11 wherein:

said step of configuring said thin film layers further comprising a step of configuring said layers L(i) with an alternate high-low refraction index configuration with layers $L(i_H)$ having a set of relatively higher refraction indexes and layers $L(i_L)$ having a set of relatively lower refraction indexes where i_H = 1, 3, 5, N and i_L =2, 4, 6, ..., (N-1).

14. The method of claim 11 wherein:

said step of configuring said thin film layers further comprising a step of configuring said layers L(i) with an alternate high-low refraction index configuration with layers $L(i_H)$ having a set of relatively higher refraction indexes and layers $L(i_L)$ having a set of relatively lower refraction indexes where i_L = 1, 3, 5, ...,N and i_H =2, 4, 6, ..., (N-1).

15. The method of claim 11 further comprising:

supporting a resonant cavity on a silicon substrate and covering said resonant cavity with said freestanding membrane.

16. The method of claim 11 further comprising:

coating an antireflection (AR) layer on the bottom of said silicon substrate.

17. The method of claim 11 wherein:

said step of configuring said thin-film layers further comprising a step of forming a polysilicon layer for at least one of said layers L(i), i =1, 2, 3, ...N.

18. The method of claim 11 wherein:

said step of configuring said thin-film layers further comprising a step of forming a silicon nitride layer for at least one of said layers L(i), i =1, 2, 3, ...N.

19. The method of claim 11 further comprising:

coating a HR coating layer on said freestanding membrane.

20. A method of forming a freestanding membrane comprising:

forming a plurality of thin-film layers represented by L(i), i=1, 2, 3, ..., N where N is a positive odd integer; and

configuring said thin film layers with a mirror symmetrical layer structure relative to a middle layer L(m) where m=(N+1)/2, and layer L(m-j) and layer L(m+j) having a same thickness, material composition, shape and size, where j=1, 2, 3, ...,(N-1)/2.